

**APPENDIX C**  
**DRAFT BURIAL TREATMENT PLAN**

**July 21, 2004**

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*Draft* Burial Treatment Plan,  
As Amended,  
For the Outrigger Telescopes Project  
Mauna Kea, Hāmākua District, Hawai‘i

TMK: Zone 4, Sec. 4, Plat 15

*Prepared for:*  
*National Aeronautics and Space Administration*

*July 21, 2004*

## **I. introduction**

At the request of the National Aeronautics and Space Administration (NASA), International Archaeological Research Institute, Inc. (IARII) has prepared a *draft* Burial Treatment Plan for the proposed Outrigger Telescopes Project at the W. M. Keck Observatory (WMKO) site. The project area lies within the Astronomy Precinct of the Mauna Kea Science Reserve on the summit of Mauna Kea on the island of Hawai'i (Fig. 1). The proposed Outrigger Telescopes Project consists of the on-site construction, installation, and operation of four, and potentially up to six, 1.8 m diameter telescopes placed around the existing Keck Telescopes on the area of the cinder cone, Pu'u Hau 'Oki, also known as Pu'u o Kukahauula for the summit cluster of cones, that was previously disturbed for construction of the two Keck Telescopes. The area of potential effect is within State Inventory of Historic Places Site 50-10-23-21438, the cluster of summit cones, and within a proposed Historic District.

Five burial or possible burial sites have been identified on the Mauna Kea summit within the Mauna Kea Science Reserve. The Reserve covers 11,288 acres leased by the University of Hawai'i from the State of Hawai'i. The Science Reserve is a circular area (2.5 miles in radius) centered on the Mauna Kea summit, and includes approximately those lands above the 12,000 foot elevation, except for those areas that are part of the Mauna Kea Ice Age Natural Area Reserve. The Mauna Kea summit is located in TMK: Zone 4, Sec. 4, Plat 15. Archaeological survey has located five sites identified as Sites 50-10-15-16195, 16248, 21413, 21414, and 21416 that are thought to be burial sites.

The proposed Outrigger Telescopes Project funded by NASA would be limited almost exclusively to the existing and previously disturbed footprint of the WMKO site within the Astronomy Precinct. This Burial Treatment Plan has been prepared for NASA at the request of the Office of Hawaiian Affairs in order to address long-term management goals associated with cumulative impacts conforming to the Environmental Impact Statement (EIS) process for this specific project. The proposed Outrigger Telescopes Project at WMKO will impact no recorded burial sites, and no inadvertent discovery is expected because of previous impact to the area. This Burial Treatment Plan is responsive to the provisions of the National Environmental Policy Act. However, since the region of influence for this proposed project includes all of the Mauna Kea Science Reserve, this Burial Treatment Plan has been prepared to consider any foreseeable impacts from the construction of the Outrigger Telescopes Project, indirect as well as direct.

The purpose of the Burial Treatment Plan is to ensure that known burials in the proposed project area are identified and protected, and that any burials inadvertently discovered during construction or maintenance activities are preserved in place or reburied on the project site in specially prepared reburial areas, depending on the situation and in consultation with lineal and cultural descendants. This Burial Treatment Plan facilitates the proper treatment of human burial remains in accordance with applicable sections of Chapter

6E-43 – Historic Preservation Law (Haw. Rev. St.; as amended), and the current administrative rules for the treatment of burial sites and human remains that were formally approved and adopted by the State of Hawai‘i in September 1996 (DLNR 1996). The Burial Treatment Plan provides the Hawai‘i Island Burial Council (HIBC) with the relevant information called for in Section 13-300-33, “Request for council determination to preserve or relocate Native Hawaiian burial sites.”

This Burial Treatment Plan provides a background on the archaeological and cultural history of Mauna Kea and its significance; a discussion of the known burial sites; a discussion of the search for lineal and cultural descendants; a proposed treatment plan for known as well as inadvertent burials; and guidelines for implementation of the proposed Burial Treatment Plan.

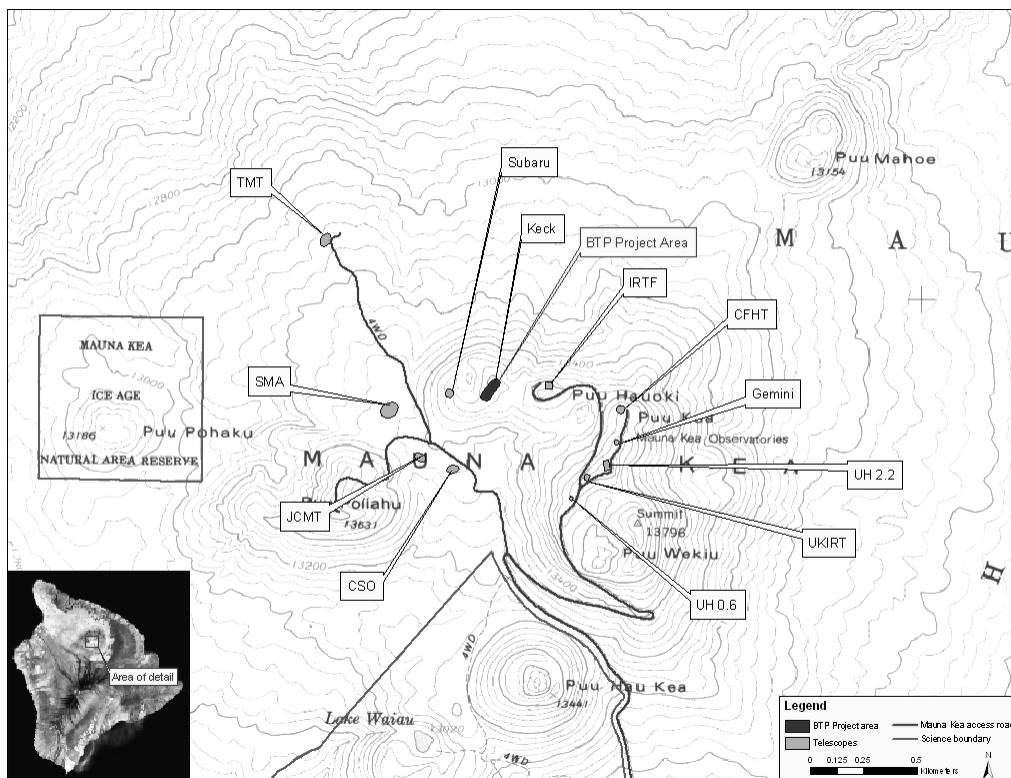


Figure 1: Location of proposed Outrigger Telescopes Project, Mauna Kea, island of Hawai‘i.

## II. Background

This background summarizes what is known of the prehistory and history of Mauna Kea from the time of initial Hawaiian settlement of the island of Hawai‘i to the recent development of observatories on the summit. It updates and adds to the documentary information provided by Kepa Maly’s (1998) archival study of Ka‘ohe and Humu‘ula

*ahupua'a*, in Hamakua and Hilo Districts (see definitions in the section on Hawaiian Traditions below), on Hawai'i Island. These two land units include most of the lands on Mauna Kea. Mauna Kea Science Reserve and Hale Pohaku are both located in Ka'ohe *ahupua'a*, following the *ahupua'a* boundaries formalized by the Boundary Commission (e.g., Baldwin 1891); U.S. Geological Survey (1982) plots both in Hamakua District.

The documentary historical study relies mainly on secondary sources – sources where original information has already been compiled. The main sources used include Maly (1998), McEldowney (1982), and Tomonari-Tuggle (1996). Other sources are cited where used. The archival collections searched by Maly and McEldowney for their studies include those at the following repositories: the State Survey Department, the Archives of the State of Hawai'i, the Bishop Museum Archives, libraries including those at Bishop Museum and the University of Hawai'i, and Mo'okini Library. One primary source added here is a collection of papers now available at the Bishop Museum Archives in Honolulu: 45 boxes of papers left by Leicester Winthrop Bryan, who served as Territorial Forestry Office for the Island of Hawai'i from 1922 to 1949, and as Territorial Forester until 1961 (Bryan 1921-1984). Materials from Boxes 2, 7, and 14, and portions of Boxes 16, 32, and 37 have been examined.

The primary sources for the archaeological information are a number of studies by Patrick McCoy, both original research (McCoy 1977a and b, 1978, 1981, 1982a and b, 1984, 1985, 1986, 1990, 1991) and compilations of work completed in both the quarry and the summit region (especially, McCoy 1999).

## ***general***

Mauna Kea, the white mountain, or the Mountain of Wakea, is one of the most prominent features of the Hawaiian Islands, rising 4,205 meters above sea level (m asl; 13,796 feet asl). From its base on the floor of the Pacific Ocean, it is one of the highest mountains on earth. During the winter months the summit of Mauna Kea is often blanketed in snow, hence the popular translation “white mountain.” In native Hawaiian traditions, however, “Kea” is also the abbreviated form of Wakea, the great sky god who, together with Papa, the earth mother, and other gods and forces, created the Hawaiian Islands. The summit is the meeting point of Wakea and Papa. In this cultural context, the summit of Mauna Kea is the domain of the gods.

These beliefs about Mauna Kea make it a highly significant and sacred place to the Hawaiian people. Mauna Kea figures centrally in Hawaiian cosmology, or and *mo'olele* (traditions, legends or stories), *mele* (song), or *'oli* (chants). According to Hawaiian beliefs, Mauna Kea is the home of a number of ancient chiefs and chiefesses who are regarded as deities. Prominent among these are Kakahau'ula, the pink-tinted snow god, Poli'ahu, goddess of the snows of Mauna Kea, and Lilinoe, her sister, the goddess of mists.

The mountain is divided into zones or levels based on altitude, physical features, and vegetation. The highest level, that of the cones of the summit, is a very sacred area reserved for the realm of deities and high chiefs and priests, while the second level, still above the tree line, is also a very special zone, reserved for use by the *ali'i* and *kahuna* (priests and masters

of arts and crafts). Lower zones on the mountain, where *mamane* and other trees grew, were for use by others, such as forest spirits and commoners (Maly 1998:7; Kanahele and Kanahele 1997:14).

This background study looks at the history of the mountain as it is known from Native Hawaiian oral tradition, from the archaeological record, and from historical accounts, documents, and maps. The first part focuses on traditional Hawaiian beliefs and oral history about Mauna Kea as recorded by native and foreign writers soon after Contact (usually defined as 1778, when Captain James Cook's ships reached the Hawaiian Islands). The second part summarizes what is known about pre-Contact Hawaiian use of the mountain from archaeological studies. The third part is a review of the nineteenth and early twentieth century history of the mountain, of the consequences of Contact, as known from both documentary and archaeological sources. The fourth part briefly summarizes recent developments on the mountain.

### ***Documentary Evidence: Hawaiian Traditions of Mauna Kea***

Early historical accounts record information concerning traditional Native Hawaiian beliefs and oral history about Mauna Kea and traditional practices and land uses on the mountain. These records, although actually transcribed after Contact, focus on earlier times and traditions. The information comes from both Hawaiian and foreign sources; some of the most detailed includes family traditions remembered by 19<sup>th</sup>-century Hawaiian Boundary Commission interviewees (Maly 1998). Archaeological information, which has been provided by several studies conducted on the mountain during the 20<sup>th</sup> century, is considered in the next section.

### **Traditional Land Units**

The Hawaiian term used by Kanahele and Kanahele (1997) for "district" (as, Hamakua, where the Science Reserve is located), is "*apana*," which is a traditional vertical land section (also, *moku o loko*, *ōkana*; Maly 1998; (Pukui and Elbert 1986). It is also a political division, because it is one of the land units that organized the Hawaiian chiefdom/state. As mentioned, the Mauna Kea Science Reserve and Hale Pohaku are both located in Ka'ōhe *ahupua'a* -- a very large, inland, vertical land division within Hamakua District. Ka'ōhe includes the summit lands, most lands on the upper slopes, and saddle lands between Mauna Kea and Mauna Loa. Humu'ula, the other *ahupua'a* researched by Maly (1998), is south of Ka'ōhe, covering lands on the lower slopes and the Hilo side of Mauna Kea, continuing beside Ka'ōhe to the summit of Mauna Loa.

In addition to the vertical land division of the landscape, Hawai'i's lands were traditionally defined horizontally, as environmental and cultural zones, *wao*, defined largely by vegetation. *Ke kuahiwi* and *ke kualono* are, respectively, the very sacred summit and the near-summit lands where few trees grow; both are very special zones on Mauna Kea. In all, 23 land zones are listed for the islands by Maly (1998:7-8). Kanahele and Kanahele ((1997:13-15), considering Mauna Kea specifically, list six zones. Downslope, below the summit zones of *ke kuahiwi* and *ke kualono* (spellings here follow Maly), are four less sacred

zones: *ka wao ma‘u kele* (below *ke kualono*; a wet area of large *koa*, ‘*ohi‘a*, lobelia, and *mamane* [botanical names and English translations provided below, in section concerning pre-Contact land uses]); *ka waoakua* (an area of more varied forest); *ka waokanaka* (the lowest forested area, the one most used as a cultural resource); and *ke kula* (the upland grassy plains). A seventh horizontal land unit, the ocean edge, is listed by Maly as *ka po‘ina nalu* and by Kanahele and Kanahele as *ke kahakai*. Although the shoreline is beyond the physical boundaries of Mauna Kea as it is usually conceived, residents of isolated upland *ahupua‘a* like Ka‘ohe typically had wide access across the shoreline to the sea beyond the inshore fisheries (Lyons 1903; McCoy 1990:111-112, citing and discussing Lyons).

Of the six horizontal land divisions on Mauna Kea, only *ka waokanaka* and *ke kula* were used for everyday purposes by Hawaiians. The upper forests and higher lands were considered special and were visited rarely, usually by specialists; they were carefully conserved. The Mauna Kea Science Reserve is located above the 3,660-m (12,000-foot) elevation, in the summit area, in *ke kuahiwi* and possibly also *ke kualono*. Hale Pōhaku (in English, stone house; (Pukui and Elbert 1986), is located farther downslope, on the east side of the Mauna Kea Observatory Access Road, at the 2,810-m (9,220-foot) elevation, in an area that still contains remnant *māmane* trees (McCoy 1985). The upper elevation and the presence of native forest suggest that Hale Pōhaku is located within one of the special and conserved forest zones, either *ka waoakua* or *ka wao ma‘ū kele*.

## Place Names from Early Hawaiian History and Legends

While Mauna Kea’s highest summit is that at Pu‘u Kūkahau‘ula (4,205 m asl; 13,796 feet asl), the mountain has many other peaks, an upland lake, and a broad upland plateau. The peaks are *pu‘u*, old volcanic cones; their traditional names reflect the great importance of Mauna Kea, the highest mountain in the islands, in Hawaiian history and legend.

Kūkahau‘ula is the traditional name for the highest peak at the summit. The name, as applied in the early maps by Baldwin (1891) and Lyons (1891), may describe only the highest peak (the “summit cone” of Mauna Kea, in Lyons 1891), the one now often called Pu‘u Wekiu or Mauna Kea peak. Alternatively, it may include all the peaks in the summit cluster, encompassing all three of the highest volcanic cones, Pu‘u Wekiu, Pu‘u Kea, and Pu‘u Hau Oki (Hibbard 1999; Maly 1998:11). Baldwin’s (1891) “*pu‘u*” may be either singular or plural. Kākahau‘ula was named for the Waimea, South Kohala, chief who became the husband of Līlinoe. Līlinoe was an *ali‘i*, a chiefess (Pukui and Elbert 1986:413), who became the woman of the mountains, the goddess of mists. They were ancestors of Pae, who was a *kupuna* (elder) and high chief in the time of ‘Umi (ca. the 16<sup>th</sup> century) and known as an exceptional fisherman. When Līlinoe died, she is said to have been buried on Mauna Kea; in 1828, Ka‘ahumanu visited the mountain to try to recover the bones. Pu‘u Līlinoe is the high peak southeast of Kūkahau‘ula (Alexander 1892a; (Kamakau 1992:215, 285); Lyons 1891; Maly 1998:11, 25).

Kūkahau‘ula, the pink-tinted snow god, was also the lover of Līlinoe’s sister Poli‘ahu. Poli‘ahu, after whom the high peak west of Pu‘u Kūkahau‘ula was named (Alexander 1892), became the goddess of the snows of Mauna Kea. She was not only the



sister of Līlinoe but the rival of Pele, the fire goddess, who lives on Mauna Loa (Beckwith 1970:179); (McEldowney 1982:1.2-1.3).

Two other names for places on Mauna Kea with particular importance in Hawaiian history and legend are Waiau and Kaluakakoi. Lake Waiau and Pu‘u Waiau are named for one of the god companions of Poli‘ahu; Maly (1998:13), translating original Hawaiian records, found that the earliest available reference to the lake by the name Waiau is that made by Hale‘ole in 1862-1863. Waiau is labeled that way by Alexander (1892) and Lyons (1891). Other sources, including Baldwin (1891), Wiltse (1862)), and earlier mappers, considered the lake an unnamed pond or Poli‘ahu’s pond.

Kaluakākoi (cave or pit for making adzes), also called Keanakako‘i (Alexander 1892a; Lyons 1891; U.S. Geological Survey 1982), is one of the main special-purpose areas near the summit. The Mauna Kea Adze Quarry, where rock, especially fine-grained basalt, was collected for the manufacture of adzes and other tools, was first mapped (for a Western survey) by its traditional name, spelled Kaluahakai, by Wiltse (1862; also, Maly 1998:11); Wiltse mapped it on the Ka‘ohe/Humu‘ula *ahupua‘a* boundary (the incorrect spelling was a transcription error; K. Maly, personal communication 2004). Alexander (1892a) and Lyons (1891) also plotted approximate locations for the quarry complex, which includes quarries, mounds, temporary habitation areas, and shrines.

## **Hawaiian Place Names that are not Traditional**

Several places have now been assigned non-traditional Hawaiian names that do not appear in early records. As an example, Pu‘u Wekiu, a name frequently used today for the highest peak (Kūkahau‘ula), was reportedly named that (*wekiu* translating into English as “summit”) in the 1920s by L. W. Bryan. The name Pu‘u Hau Oki, which translates into English as “frosty peak”, for the westernmost summit cone was also first recorded by Bryan in the 1920s (Hibbard 1999, citing 1973 Bryan letter). Hale Pohaku was named by Bryan for two stone cabins he and the Civilian Conservation Corps built in 1936 and 1939 for use by visitors to the mountain (Bryan 1921-1984:Box 2.6-2.7; e.g., June 21, 1939, log entry). Hale Pohaku is now used as the University of Hawai‘i Institute for Astronomy's Mid-Level Facility and visitors’ center, as well as a staging area and construction camp.

## **Archival References to Pre-Contact Land Uses**

As mentioned earlier, the written information relating to traditional land use on Mauna Kea actually comes from documents, especially transcribed Hawaiian oral testimonies, that were compiled in the 19<sup>th</sup> century, after Contact. The following information is summarized from McEldowney ((1982), and from information translated and annotated by Maly (1998). Among the most informative original sources used by these and other historians are the native testimonies in the five-volume Boundary Commission Book for Hawai‘i, prepared in the 1870s to formalize land boundaries according to the Western system; and historical maps including those cited earlier (Alexander 1892)a, Baldwin 1891; Lyons 1891; Wiltse 1862). Other sources include records left by early foreign visitors, although it is

not always known whether the original source for much of this information was Hawaiian or another foreigner (1982:1.7).

Maly (1998:45-46), introducing the land-use information that is provided by the Boundary Commission testimonies, organizes the traditional land uses by zone: lower forest to upper forest, and upper forest to summit. The following summary is organized by site and land use type, with comments regarding the zones that were important for each.

Main trails and footpaths served the lower slopes and also provided access to lower and upper forest zones on the mountain, providing bird catchers and others access to resources including the forests and the adze quarry. Kamakau (1992:16) mentions the trail of Poli‘ahu, which had been used by ‘Umi in the 16<sup>th</sup> century: “It was shorter to go by way of the mountain to the trail of Poli‘ahu and Poli‘ahu’s spring [Waiau; K. Maly, review comment 2004] at the top of Mauna Kea, and then down toward Hilo. It was an ancient trail used by those of Hāmākua, Kohala, and Waimea to go to Hilo.” ‘Umi’s party of warriors descended via the trail to Kaūmana (above Hilo), camping on the way just above Wai‘anuenue Stream (Kamakau 1992:16-17).

Among the main trails is one that figured in a Humu‘ula/Ka‘ohe border dispute, probably the one mentioned in Waiki’s testimony to the Boundary Commission; it passed from Lahohina (Pu‘u Lahohinu, northeast of the summit), to or through Laumaia (Gulch, east of the summit), above the forest. The best-documented trails provided access to lower forest zones (e.g., *ka waokanaka*) and certain upper forested lands, from the lowlands or the Saddle (Maly 1998:52; McEldowney 1982:1.7-1.8).

Forest birds including *o‘o* (native honeycreepers, *Noho* species; Hawaii Audubon Society 1993:103) were hunted for their colorful feathers in the lower forests on the mountain. *He mau wai kōloa*, native duck ponds, were also mentioned in testimonies made to the Boundary Commission. Seabirds including especially ‘*ua‘u*, the dark-rumped petrel, and *nene* (*Pterodroma phaeopygia sandwichensis* and *Nesochen sandvicensis*; Hawaii Audubon Society 1993:10, 49) were hunted in the Saddle area, on the lower slopes (again, in *ka waokanaka*), and possibly at much higher elevations (Maly 1998:45-47; McEldowney 1982:1.7-1.8). Lyons (1903:25) indicates that the “owners” of Ka‘ohe possessed the sole right to capture ‘*ua‘u*.

Hardwoods harvested in the forests included *koa* (*Acacia koa*) for canoe-building. The very durable wood of *māmane* (*Sophora chrysophylla*) was valued for ‘*ō‘ō* (spades, digging sticks) and the runners on sleds (Neal 1975:443; Pukui and Elbert 1986:236). Lyons (1903:25) indicates that the upper limit of the *māmane* forest coincided with that of Humu‘ula (Hilo District). *Pili* grass (possibly mountain *pili*, either *Panicum tenuifolium* or *Trisetum glomeratum*; Wagner et al. 1990:110, 1573, 1602) was collected on lower slopes, along with bananas and *hāpu‘u* (*Cibotium*, tree fern). And ‘*ōhi‘a* (*Metrosideros polymorpha*) formed extensive forests in areas below the *māmane* forest, in the saddle (as reported by Hawaiians to William Ellis in 1823) and in the Hakalau Forest on the Hilo slope (Maly 1998:38; Tomonari-Tuggle 1996:11-16). As mentioned, ‘*ōhi‘a* was an important component of *ka wao ma‘u keke*, the wet, uppermost forested *wao*.

Near the summit, in the highest zones, Kaluakāko‘i, the Mauna Kea Adze Quarry, was used by lithic specialists, specialists in the manufacture of stone tools, for the collection of rock, especially fine-grained basalt (hawaiite), which was worked into adzes for canoe-making and other purposes. The historical records that are most informative about use of the quarry prior to Contact (most of the available information is archaeological and covered below) include Waiki’s testimony before the Boundary Commission (Maly 1998:46, 49-52, “Haiki” in McEldowney (1982:1.7)). To support his claim that the Ka‘ohe/Humu‘ula *ahupua‘a* boundary had actually passed across the summit (west of the current boundary, the location finalized by the Commission), Waiki cited Kaluakāko‘i and a cave on Poli‘ahu as landmarks along the boundary. Waiki was born ca. 1819; his father and grandfather were bird catchers and canoe-makers and had traditionally collected stone for adze-making at the quarry. His father-in-law pointed out traditional boundaries to Waiki, who assisted Wiltse ((1862) in surveying Humu‘ula. The testimony of Kahue, another informant, agreed that resources and lands in Humu‘ula included Kaluakāko‘i, Poli‘ahu, and also Waiau (Maly 1998:46, 49-52).

Other site types on the mountain mentioned in testimonies and other historical documents include, importantly, burial sites; other ceremonial sites, which include bird-snarers’, adze-making, and other shrines, primarily uprights and *ahu* (cairns and altars); special places such as those where *mele* were sung; and *kauhale* (house compounds, each composed of a group of buildings such as eating houses, sleeping house, and cookhouse) (Maly 1998:11, 46; Pukui and Elbert 1986:135).

The burial sites listed for the Boundary Commission by Hawaiian informants are located several kilometers northeast of the summit, at slightly lower elevations. They include a site at Pu‘ukuka‘iau, likely the point mapped by Lyons (1891) as “Kuka‘iau,” approximately 17 km northeast of the summit (in Kuka‘iau *ahupua‘a*); a site or sites at Keahuonaiwi, on the slope of Pu‘ukihe, 11.5 km northeast of the summit (on the boundary between Kuka‘iau and Koholalele *ahupua‘a*, as mapped by Lyons, but reportedly belonging to Ka‘ohe); a site at ‘Iolehaehae (also 11.5 km northeast of the summit); and in unspecified areas. Several 19<sup>th</sup>- and 20<sup>th</sup>-century visitors commented on the former use of the summit and the upper slopes and plateau, both in the uppermost two horizontal environmental zones, for burial (Maly 1998:46, 53, 57; (McEldowney 1982:1.8-1.9). Lyons (1891) reported a burial site at Keonenui, around the 2,896-m (9,500-foot) elevation, a short distance southeast of ‘Iolehaehae. In 1892, Alexander’s party observed burials and a possible *heiau* on Pu‘u Līlīnoe, on the east side of the Humu‘ula Ranch Trail (also called the Humu‘ula-Mauna Kea Trail) to Waimea.

Alexander noted:

...the surveyors occupied the summit of Lilinoe, a high rocky crater, a mile southeast of the central hills and a little over 13,000 feet in elevation. Here, as at other places on the plateau, ancient graves are to be found. In the olden time, it was a common practice of the natives in the surrounding region to carry up the bones of their deceased relatives to the summit plateau for burial [Alexander 1892b].

Shrines recorded in traditional Hawaiian history and legend near the summit, in the highest land zone, include, in addition to the possible *heiau* at Pu‘u Līlīnoe, Pōhaku a Kāne, a sacred platform or *ahu* perched above the sacred water of Kāne; and an *ahu* or mound at Waiau, near the Humu‘ula-Mauna Kea Trail (Maly 1999:15). Pu‘u Kōle was a *kūahu* (altar) *manu*, an altar for bird catchers, with a *kauhale*, located around 2,400 m asl, midslope, in Laupahoehoe (below Pu‘u‘ula‘ula, northeast of the summit). A large *ahu* was located at Mākanaka, a *kūahu* in Ahuapo‘opua‘a (in Humu‘ula), and an *ahu* (called Keahu o Kuakini by the 1870s) in Pōhakuloa (Maly 1998:28, 30, 45-46, 48). Both of these were located in upper forest or higher lands. *Mele* (chants) were sung in gulches including Kahawai Koikapue, whose waters were shared by Ka‘ohe and Humu‘ula (Maly 1998:48). *Kauhale*, in addition to the one just mentioned, included upland houses in Humu‘ula and other areas, as mentioned by Boundary Commission informants (Maly 1998:46-47, 49, 50, 52). Most were located in the lower or upper forest zones.

Sacred and special-purpose sites were present in several traditional zones, from the base to the summit of Mauna Kea, and in various *ahupua‘a* around the mountain. The other land uses, such as the use of trails, quarrying, and bird-snaring, either occupied small portions of their zones or had only transitory effects on the environment (for instance, wearing a path or harming a single tree), conserving the forests and other lands where they occurred.

### ***Archaeological Evidence for Pre-Contact Land Uses of the Mountain***

Archaeological surveys of the summit region, the Mauna Kea Adze Quarry, and Hale Pōhaku have documented many archaeological sites that indicate Hawaiian visits to Mauna Kea before Contact in 1778. Excavations of workshops and shelters within the quarry have yielded especially rich information about native Hawaiian practices on the mountain.

### **Polynesian Settlement of the Island of Hawai‘i**

Polynesians sailing from islands to the south, in east central Polynesia, may have arrived in the Hawaiian Islands as early as 1,600 years ago and had certainly reached the islands by 1,200 years ago. The evidence for early settlement on the island of Hawai‘i itself remains rather unclear. The earliest well-dated site is Wai‘ahukini rockshelter, a site near South Point, used mainly as a fishing camp based on the large numbers of fishhooks and other fishing gear recovered. Both charcoal and shell samples from the lower cultural layer suggest occupation began between A.D. 650 and 850 (Emory and Sinoto 1969; Spriggs and Anderson 1993). On O‘ahu the picture is somewhat clearer; there is evidence from many locations on the island that show a major change in the lowland environments occurred about A.D. 850-950. These changes are clearly associated with the arrival of human colonizers of the islands and, perhaps more significantly in terms of the impact on vegetation, of the Pacific rat that came with the Polynesian voyagers (Athens et al. 2002). The early settlements were located along the coasts of the islands in locations that provided easy access to land well-suited for growing taro (*Colocasia esculenta*, an aroid with edible leaves and underground stem [corm];

the main Hawaiian staple food) and other crops. There is no archaeological evidence for use of the high inland areas during the first few centuries of settlement.

It was probably in these early years of settlement that the Hawaiian traditions and beliefs discussed above, about the highest place on the island, the summit of Mauna Kea, took form. Mauna Kea came to be regarded as sacred, the abode of the gods, a sacred place between earth and the sky, home of Wākea. However neither archaeology nor the much later documents of the post-Contact period provide evidence about the initial development of these traditions.

## **Early Journeys to the Mountain**

Archaeological evidence suggests that Hawaiian entry into the region of the high volcanic mountains, Mauna Kea and Mauna Loa, and the Saddle between them, began in the 12<sup>th</sup> or early 13<sup>th</sup> century. The Hawaiians began using the lava tube caves and blisters along the lower slope of Mauna Loa in the Pōhakuloa portion of the Saddle for shelter about this time, based on a large series of radiocarbon dates from firepits in several of these shelters (Athens and Kaschko 1989; Reinman and Schilz 1994). Associated with these firepits are stone flakes, bird bones, and, rarely, marine shells, the remains of the materials left behind by the early expeditions. Hawaiians stayed overnight in these shelters probably while hunting the birds that inhabit the *māmane* and *naio* forests of the Saddle, and perhaps collecting stone for manufacturing tools from small dikes of basalt and volcanic glass that are found in the Pōhakuloa area (Bayman et al. 1999; Williams 2002).

During this same period and perhaps even earlier (McCoy 1999), Hawaiians began making their way up the slopes of Mauna Kea, camping in rockshelters near the summit. The goal of the earliest pilgrimages is uncertain; most likely they were made for spiritual reasons to honor the gods associated with the mountains, perhaps to make astronomical observations, perhaps in connection with navigation. Whatever the reasons, near the summit, on the south side of the mountain, they discovered large deposits of a very hard, fine-grained volcanic rock, now called hawaiiite by geologists, a stone of much higher quality for stone tool-making than the dike and extruded basalts found elsewhere. Radiocarbon dates from the earliest of the campsites used by Hawaiians procuring stone at the quarry demonstrate that by A.D. 1100 to 1300, at the latest, Hawaiians were journeying to areas near the summit of the mountain.

## **Procurement of Stone: the Mauna Kea Adze Quarry**

For the next 500 years, until the beginning of sustained Western contact (after Captain Cook's arrival), groups of Hawaiians would journey to the summit to collect stone from the treeless alpine desert on the south side of the mountain. Most quarry sites are clustered in a 4-sq-km area between 3,350 and 3,780 m (11,000 and 12,400 ft) in elevation, although some extend down to about 2,600 m (8,600 ft).

The attractiveness of the stone for the tool-makers was the result of the unusual conditions in which it formed. During several intervals during the Pleistocene, the volcano summit region was capped by glacial ice. Geological interpretation suggests that the very

dense, fine-grained hawaiiite found on the upper slopes of Mauna Kea was formed as a result of a lava flow eruption beneath the ice cap, causing the magma to cool exceptionally quickly (S. C. Porter's 1987 research, cited, McCoy 1990:93). This quick-cooled lava yielded an especially fine-grained stone that could be turned into high-quality adzes, tools used traditionally to cut trees for woodworking and then to shape the wood for canoes and many other objects. One such eruption formed an escarpment of dense rock on the south side of the mountain below Lake Waiau, and this escarpment became the focus of stone procurement and working.

The scale of the enterprise was greater than any other of this type in Hawai'i. The quarry, including less intensively worked areas below the escarpment, was defined as covering 12 sq km, larger than all other known stone quarries combined. Archaeologists working at the quarry have identified over 264 workshop areas. These include areas where the stone was obtained and initially processed into blocks that could be taken elsewhere. Others are places where these blocks were further refined by percussion chipping. Some of these workshops include huge piles of waste debitage over 5 m high where the raw material was processed into "preforms" that could serve as blanks for making adzes (the most important Hawaiian tool for working wood).

When staying on the cold summit while working at the quarry, the Hawaiians protected themselves in the small rockshelters that are found on the mountain slopes. In these shelters there is evidence of the foods that the Hawaiians carried to the summit, hearths for cooking the food and for warmth, and stone flaking debitage. The entrances of many shelters were enclosed by rock walls. '*Opihi* shells may have been used as peelers for removing the corm or underground stem of the taro, which seems to have been one of the most important foods for those working at the quarry. Bird bone awls and volcanic glass flakes, used respectively to pierce and scrape wood and other soft materials, were other common tools. In one shelter an awl and flakes were found with pandanus leaves, possibly suggesting repair of mats or baskets, but it is perhaps more likely that the pandanus leaves were for use in offerings. Other perishable materials recovered in one of the shelters were a possible ti-leaf rain cape, sandal fragments, twisted cordage, and braided sennit (Allen 1981). In another shelter a silversword was found, wrapped with pieces of tapa cloth, pandanus leaf, and a wooden bottle gourd stopper with sennit cord attached. Food remains include shells of sea urchins, a barnacle, and marine mollusks including '*opihi*; and bones of fish (at least eight families represented), bird, most of which is probably dark-rumped petrel, but which also includes small numbers of native birds that are now rare or extinct (the Hawaiian rail, coot, goose, duck, and crow, and honeycreepers); and mammal (pig, dog, and Pacific rat). Cultivated plants found at these sites most commonly are taro, ti, sugar cane, and gourd; seeds and fruits of wild plants are also common. The wild plants may have been available on the slopes of the mountain; others, such as the taro, ti, sugar cane, and gourd, were grown at lower elevations and carried up to the quarry.

From the hearths used for cooking and warmth come the fragments of charcoal that are used to date by radiocarbon analysis the use of the summit. Charcoal samples from the basal layers in three rockshelters have been dated to between A.D. 1100 and 1300, indicating

that use of the quarry began within this period. The largest number of dates fall within the A.D. 1300-1650 year range, suggesting that this was a period of major use of the quarry.

An important aspect of the quarrying was the construction of shrines. As many as 45 shrines, identified as such on the basis of the presence of one or more upright stones, are found within the quarry. Most of these are directly associated with stone workshops or are above rockshelters, and their construction is therefore interpreted as relating to quarry activities. According to McCoy (1990), the surfaces of many shrines mimic workshops, with adze-manufacturing by-products scattered beneath the uprights, suggesting their use as ritual offerings. The shrines clearly reflect the close integration of spiritual beliefs and material practices in traditional Hawaiian culture.

## Ritual Sites on the Mountain

In addition to the many shrines associated with the adze quarry, shrines are found in locations on the mountain where no evidence has been recovered to suggest any material resource procurement. For example, above the quarry, archaeological survey to date has revealed the presence of 93 sites within the Science Reserve; an additional 10 sites have been recorded high in the Natural Area Reserve, around Lake Waiau. Seventy-six of these are shrines, each comprised of a single upright stone or of multiple upright stones set together in a row or rows or grouped within a paved court area. Eight additional shrines are part of four adze-manufacturing workshops separate from the quarry.

The distribution of the shrines is of importance in interpreting their use and the traditional Hawaiian activities at the summit. Although *ahu* or *heiau* recorded historically (in documents) include one at the summit, the shrines recorded archaeologically in the Science Reserve are all located on the summit plateau, with none on the central summit cones or in their immediate vicinity. Most are located between 3,901 and 4,023 m (12,800 and 13,200 feet) in elevation and are concentrated most heavily on the north and northeast side of the mountain. The absence of shrines on the summit and their presence on the plateau may reflect environmental differences between the *pu'u* and the plateau, may result from differential preservation, or may suggest that the core summit region from about 4,023 m in elevation to the highest cone was largely avoided because of its high degree of sacredness.

The concentration of sites on the north and northeast sides also could be the result of survey bias or differential preservation, as the south side of the mountain has been more intensely modified in the past century. However, the distribution might also suggest that the usual approach to the mountain was not from the Saddle but rather from north side of the mountain. Although historical accounts such as that concerning the Poli'ahu Trail, used by 'Umi in the 16<sup>th</sup> century, document the use of trails from other directions, as well. It seems in any case that most access to the summit was intended for high-ranking *ali'i* from the population centers of Ka'ohē and Hāmākua, the *ahupua'a* and district within which the summit falls (according to the current boundaries).

In the absence of any organic remains associated with the summit shrines, it has not been possible to date directly the time of their use. Their similarity in style to the shrines in

the adze quarry complex suggests that their time of construction and use may correspond with those dated shrines. However, the use of uprights as the central focus of the shrines is similar to early *marae* (temples) common in the islands of central and eastern Polynesia, the area from which the Polynesian voyagers came to Hawai'i. This could be an indication that the first construction of these shrines may have begun quite early after Polynesian colonization, perhaps even earlier than the use of the quarry. Later, the use of uprights as the central focus of religious structures was replaced with a new type of temple structure as the Hawaiian *heiau* developed. McCoy (1982a, 1990) suggests that the summit region shrine complex reflects a historically undocumented pattern of pilgrimage to worship the snow goddess, Poli'ahu, and the other mountain gods and goddesses.

Based on present knowledge, it seems that there are eight cairn sites on the summit plateau, of which one has been confirmed as containing burials and four others of which are considered likely to contain burials, based on similarities in form and placement to the known burial sites. All possible burial sites are located on the rims of cinder cones, although not on any of the highest cones at the summit itself. The known burials are on Pu'u Mākanaka, northeast of the summit, three possible burials are located on cones northwest of the summit, and one is located on Pu'u Līlinoe, southeast of the summit. The distribution of burial sites, like that of shrines and other sites, may reflect differential preservation or may, as suggested by the burial places remembered by historical interviewees (e.g., Maly 1998:46, 1999:18-19), reflect a traditional preference to inter burials near the summit, but not in the most sacred region at the summit itself.

### ***Post-contact Land Uses and Environmental Change***

Contact with the Western world, beginning with the arrival of Captain Cook in the islands in 1778, altered in significant ways the relationship of the native Hawaiians with Mauna Kea. These changes completely alter the patterns of use, as reflected in the archaeological record of the post-Contact period, compared with that for the period before Contact.

### **Factors Causing Change after Contact**

A number of factors were responsible for these post-Contact changes. The effect that appears to have been felt first and very rapidly after Contact was the reduction of the demand for stone tools with the introduction of iron and the very rapid and widespread adoption of iron tools by the Hawaiians. While the use of stone tools did not disappear (iron and stone tools are found together at some early post-Contact sites), iron replaced stone for most uses, and the need for new lithic raw material disappeared. As a result quarrying activities on the Mauna Kea summit appear to have ceased very soon after Contact. As noted above there are already indications in the archaeological record of decreased use during the last century before Contact. No materials introduced after Contact are found in the sites at the Mauna Kea Adze Quarry complex, nor are there the discarded remains of any animals and plants that were introduced after Contact.



The presence of only one reference in the early historical literature to actual quarrying on Mauna Kea (by the father and grandfather of Waiki, the man mentioned earlier who was born ca.1819) also suggests that these activities ended soon after Contact. Early European visitors to Mauna Kea observed the piles of flakes and adze preforms and the shelters, but are quiet in terms of any discussion of Hawaiian stone procurement or tool manufacture (e.g., McCoy 1977a and 1978:1, citing Joseph Goodrich, who accompanied Ellis to the summit in the 1820s and was the first to document the existence of the Mauna Kea Adze Quarry). This is interpreted as suggesting the rapid demise of stone adze manufacture and thus a reduced need for the raw stone material after the introduction of iron.

Several other factors were to reduce significantly the presence of Hawaiians on the mountain after Contact. The changes in Hawaiian social organization with the introduction of foreign ideas and goods and the unification of the islands under Kamehameha I produced changes that affected the use of this area. Regalia based on Western models began to supplant the traditional ways of expressing rank, such as the wearing of feathered cloaks by the *ali'i*, reducing the demand for hunting the colorful feathered birds in the upland forests. The introduction of foreign diseases to which the Hawaiians had no developed immunity severely reduced the population. The abolition of the *kapu* system in 1819 by Kamehameha II and others (Queen Keopuolani and Queen Ka'ahumanu), and the coming of Christian missionaries beginning in the following year ended certain traditional ritual practices and meant that those who continued to practice some of the traditions did so less conspicuously. Even though old shrines may have continued in use, new shrines were probably no longer ritually erected on the mountain. Thus the near-absence of clearly traditional sites on the summit is not surprising. While the traditional practices associated with the mountain were certainly not completely abandoned, as might be thought from reading the 19<sup>th</sup>-century documents of those non-natives who traveled around or up the mountain (discussed below), they were not as prevalent as in pre-Contact times.

## **Introduction of Cattle and Sheep and Environmental Degradation**

Widespread environmental change began on the slopes of Mauna Kea soon after the introduction of cattle in 1792-1793 by Vancouver, who brought them from California. Vancouver gave cattle to Kamehameha I, who placed a *kapu* (restriction) on them for 10 years after Contact. Cattle were allowed to roam free and their numbers multiplied; soon they were grazing over wide areas that included the slopes of the mountain (Kamakau 1992:164; Kuykendall and Day 1962:33-34). By the 1820s the hunting of wild cattle was commercialized, supplying whaling and other ships with meat. By the 1830s, tallow and hides were also exported, and cattle ranching developed in Waimea. Wild cattle soon destroyed much of the vegetation cover on slopes where they grazed, turning native forests, shrub lands, and grasslands into pasturelands covered by introduced grasses. Cattle were observed by Ellis's party on the slopes above the forested zones by 1823 and, by 1840, were plentiful near the summit, as observed by Charles Wilkes, who commented that they must have been there either to drink snow or to escape hunters, as there was no vegetation to graze. Wilkes also commented on the fleas the cattle brought; insects thrive in cattle herds.

Between 1855 and 1868, Charles de Varigny commented that *nēnē* were being hunted to extinction in the saddle area, and were being replaced for purposes of hunting by cattle, boars, and wild dogs. Wild pigs, whose arrival on Mauna Kea is not well-documented, spread invasive introduced plants, harming the forest understory and the native forest birds who had formerly fed in it. Feral pigs were still present in 1985-1986 in areas where *māmane* grew, near Hale Pōhaku (Bonk 1986). Pigs would also have fed on tree ferns, as they do elsewhere, encouraging water to pool in the stumps and inviting mosquitoes to breed. The Humu‘ula Sheep Station was established, informally in 1856 to take advantage of feral sheep already present in the saddle (Maly 1998; Staples and Cowie 2001; (Tomonari-Tuggle 1996:17-18, 38-40)).

Firewood and other lumber were harvested commercially soon after Contact, decimating *koa* forests on Mauna Kea and elsewhere. *Pulu*, a silky fiber collected from *hāpu‘u*, the tree fern, was collected for export as pillow and mattress stuffing. Sugar cane was planted extensively on lower lands, below the forests, by the mid-19<sup>th</sup> century. Sugar mills needed large amounts of firewood, further depleting the mountain forests above, and their flumes both diverted mountain water and transported forest lumber downslope (Kuykendall and Day 1962:122; (Tomonari-Tuggle 1996:18-19, citing earlier sources).

In 1892, Alexander and his party, noting the spread of grass on the slopes, commented that, if not for the scant rainfall, they would be superb grazing land. He also reported that the *māmane* forests had all but disappeared on the western side of the mountain, and that even ‘*ahinahina* (silversword, *Argyroxiphium sandwicense*; Wagner et al. 1990:261), high on the slopes, had nearly vanished (Maly 1998:38-41, 57-58). Many visitors, Hawaiian and foreign, had commented on the sandy nature of the upper-slope soils and sediments on Mauna Kea; Wilkes noted that the *pu‘u* were composed of knee-deep loose sand. The stripping of tree and shrub cover would have led to increasing erosion on all slopes in the uppermost zones and those in deforested areas below, although that is not specifically noted in available 19<sup>th</sup>-century reports.

## **Nineteenth-Century Visits to the Mountain**

Early European and American visitors reported difficulty obtaining guides to the highest areas on Mauna Kea. Although the reason was almost certainly the sacredness and special status of the mountain, especially the uppermost zones, in Hawaiian culture, some visitors concluded that the interior area was a virtually unknown wilderness (Maly 1998:38, quoting William Ellis in 1823). Foreign visitors apparently began to climb the mountain soon after Contact, as Joseph Goodrich, accompanying Ellis in 1823, found a rock cairn at the summit that he believed had been left by an even earlier visitor. Goodrich also mentioned foot paths through the large sandy region downslope.

Visits to the mountain increased in both frequency and in the numbers of people involved throughout the 19<sup>th</sup> century. In 1830, Kamehameha III, visited the mountain on horseback, along with Hiram Bingham. In 1840, the Wilkes party (the U.S. Exploring Expedition party) documented Lake Waiau. In 1862, Wiltse and others began surveying boundaries on the mountain for the Boundary Commission. Isabella Bird, who

traveled through many tropical lands, visited Mauna Kea in 1873. In 1882, J. S. Emerson, surveying other areas on the island, sketched Mauna Kea. In 1883, Queen Emma traveled over the mountain to Waimea; a pillar or cairn built to commemorate her visit was observed in 1892 by Alexander (1892b). In 1889 and 1891, E. D. Baldwin mapped the summit and near-summit areas, preparing his 1891 map (Baldwin 1891; Maly 1998).

Other changes during the 19<sup>th</sup> century included the building of cairns to commemorate visits. Two have been mentioned: the one built for Queen Emma's visit, and the one at the summit observed much earlier, in 1823, by Goodrich, with Ellis's party. The Wilkes party erected a cairn in 1840. In 1891, Baldwin's party erected a cairn on the summit (Maly 1998); and, the following year, Alexander (1892b) built "a solid pier of masonry," with a flat rock for a pendulum apparatus. Three cairns are the only archaeological sites on the summit plateau that have been recorded during recent surveys (McCoy 1999).

Most of these groups traveled on horses, who, along with the cattle, no doubt obliterated many small earlier trails. Larger, wider roads built in the mid-19<sup>th</sup> century included the Judd Road, started in 1849 (south of Kailua, Kona) but completed only to a point just short of the 16<sup>th</sup> milepost; construction ceased in 1859. Built by prisoners, it was to cross the saddle all the way to Hilo. The mileposts were of 'ōhi'a wood. The road, at its 14-mile point, passed very near Ahu o 'Umi, a *heiau* said to have built by 'Umi in the 16<sup>th</sup> century to celebrate a victory (Bryan 1921-1984:Box 7.10 [article and photographs originally published in the *Hilo Tribune Herald*, April 17, 1960]).

## **Late Nineteenth-Century Ranching**

The Saddle and the lower slopes of the mountain witnessed the development of two large ranches in the late 1800s. These competed for the rights to raise cattle and sheep and hunt feral animals in the region. John Parker II held a lease to lands in Ka'ohe from sometime before 1876. The Waimea Grazing and Agricultural Company leased Humu'ula to the east from Kamehameha III around 1860 and raised sheep and also killed wild cattle for their hides. Their one sheep station along the current Mauna Kea Observatory Access Road, just above today's Saddle Road, was a remote and rather lonely place. A wagon road was built from Humu'ula to Waimea to transport wool to the harbor at Kawaihae. By 1885 the Humu'ula lease was held by the Humu'ula Sheep Station Company, which in that year obtained the lease for the east side of Ka'ohe, while Parker Ranch continued to lease the west side. The company hired immigrant Japanese stonemasons to build stone walls around their grazing lands in the 1890s; portions of these are still standing. After 1900 Parker Ranch expanded and took over control of the Humu'ula Sheep Station Company, and most of the lands in the Saddle became a part of Parker Ranch (Langlas et al. 1997; Peterson 2003).

In the late 19<sup>th</sup> century, the main trails on Mauna Kea increasingly merged with those serving the Humu'ula Sheep Station and Umikoa Ranch wagon trails, and additional roads began to appear. Among the better-known today are the Humu'ula-Mauna Kea Trail, on the Hilo side of the mountain, and the network of trails that join to become the Kahinahina Jeep Trail, which serves the upper slopes and circles the mountain (e.g., Bier 1988; McEldowney

1982:1.12-1.13). All these roads provided increasingly easy access to all the traditional *wao* (environmental zones), and to the summit.

## **Early Twentieth Century**

The 20<sup>th</sup> century brought additional, and rapid, change, especially with the planting by foresters of imported trees and other plants; and with road construction and the establishment of the observatories on Mauna Kea. Sheep were still numerous on the slopes in the 1930s -- some 40,000 around the mountain. One of L. W. Bryan's tasks as head of the Civilian Conservation Corps (CCC) was to build a sheep-proof fence around the summit of the mountain, to protect the remaining *māmane* forest and also the silversword, which he commented in a 1974 letter had been devastated by wild sheep. *Māmane* continued to be endangered in the 1970s, the cause debated but possibly involving all of the cited causes: sheep, cattle, goats, fires, lumbering, and the growth of grasses that compete for the soil moisture needed for *māmane* seed germination (Bryan 1921-1984:Boxes 2.5 [inspection on 12/27/1935], 7.1 [1974 letter], 7.3 [newspaper articles]; (Tomonari-Tuggle 1996:18).

The CCC improved one of the main early roads, the Keanakolu Road, on the east side of the mountain, so that automobiles could now circumnavigate it. Bryan, as Forestry Officer and later Territorial Forester, eventually assumed the direction of the reforestation of denuded lands that had been initiated by Harold L. Lyon and the Hawaiian Sugar Planters Association in 1918, planting large numbers of trees – most of them introduced species – to control erosion (Bryan 1921-1984:Box 7.5 [brief history of Hawaiian forestry]; (Tomonari-Tuggle 1996:42-44)). The reforestation undoubtedly prevented much soil erosion, but also resulted in the additional isolation of the remaining patches of native forest.

Bryan and the CCC built the two stone cabins at Hale Pōhaku in 1936 and 1939, for use by visitors (Bryan 1921-1984:Box 2.6-2.7 [e.g., June 21, 1939, log entry regarding laying out second cabin]; (Pukui and Elbert 1986:38-39). Both have been preserved and remain in use today.

## ***Recent Developments: Observatories on the Mountain***

The road improvements undertaken by the CCC were the first steps toward making the mountain more accessible and opening up new opportunities. With the coming of World War II, the U.S. Army took control of a large area in the western portion of the Saddle to use for training. This area was to remain in military hands after the war, developing into the Pōhakuloa Training Area, closing a large portion of the Saddle to public or private commercial use. However, the use of the area for training and the concern with providing an access route in case of Japanese invasion led to the construction of a graded, all-weather road through the Saddle by the CCC and U.S. Army Corps of Engineers in 1943. After the war, the Saddle Road, linking Hilo with Waimea, was paved, further easing access to Mauna Kea [Langlas et al. 1997:26].

In the early 1960s, interest grew in establishing an observatory on the summit. A paved road already existed from the Saddle Road at the base of the mountain to Hale Pōhaku.

In 1964, a road was graded and graveled from Hale Pōhaku to the summit (Pickles 2003). The construction of this road, which became the Mauna Kea Observatory Access Road, opened up access to the summit and initiated intensive modification of the summit region.

Bishop (2003:27) provides a list of the main telescopes built at the observatories from 1968 through the present, with the years of their installation, beginning with the Air Force 0.6-m optical telescope south of the summit ridge in 1968. Its installation was quickly followed by a several other telescopes in the following five years, and then, in 1979, three telescopes. Following the completion in 1983 of a development plan, construction of new telescopes in the newly recognized Science Reserve resumed. Between 1986 and 1999 the submillimeter array, the Keck telescopes, the Very Long Baseline radio antenna (VLBA), the Subaru, and Gemini telescope were completed (Pickles 2003:46). Farther downslope, several observatory-related projects have also involved additions or modification of facilities at Hale Pōhaku, including building of a dormitory for Subaru personnel. The stone cabins built by the CCC in the 1930s remain in place.

Increased access to the mountain and the need to evaluate the consequences of the development of the observatories has led to a number of cultural resource and environmental studies during the past 30 years. This research has included an intensive archaeological study of the Mauna Kea Adze Quarry by Bishop Museum under the direction of Patrick McCoy beginning in 1975 and 1976, archaeological surveys of the summit and extensive areas on the south side of the mountain, and the biological discovery and study of the rare *wēkiu* bug.

In 2002 the Keck Observatory and NASA proposed the construction of six 2-m-class telescopes to enhance the resolution of the Keck telescopes. The proposed project would join a complex of highly sophisticated astronomical observatories and contribute to the world-class significance of the astronomical information produced by investigations at the summit of Mauna Kea.

### **III. Identification of Burial Sites**

#### ***MAUna Kea Science Reserve burials***

Previous archaeological surveys of the Mauna Kea Science Reserve have documented numerous cultural resource sites, some of which have been identified as human burials. Oral history investigations document that there have been many other burials, including subsurface interment or burial as well as aerial dispersal of cremated human remains. This section of the Burial Treatment Plan identifies the areas where known burials have been reported (McCoy 1999). Five burial locations have been recorded as State of Hawai'i archaeological sites (Table 1 and as shown on Fig. 2).

Figure 2: Burial locations on map of Mauna Kea Science Reserve (this figure has been withheld from publication in conformance with provisions of State of Hawai'i and Federal law)

Table 1: Burials and possible burials included in site list from McCoy (1999:Table1).

<b>State Site No.</b>	<b>Elevation (ft. asl)</b>	<b>Description</b>	<b>Function</b>
16195		2 cairns	possible burial
16248		series of cairns	burial
21413		cairn	possible burial
21414		cairn	possible burial
21416		cairn	possible burial

McCoy has conducted archaeological reconnaissance surveys in the Mauna Kea Science Reserve since 1979. Recently he updated much of this work for the Mauna Kea Science Reserve Master Plan (McCoy 1999). In that document, he defined a number of site types, as discussed in the background section of this Burial Treatment Plan. Among those definitions he included a type for known burials, as “a deliberate or intentional interment of human remains” and added, “all of the known and suspected burials in the Science Reserve are located in cairns situated on the tops of cinder cones” (McCoy 1999:3). He further discussed “Burials and Possible Burials - There are numerous references to human burials on the northern and eastern slopes of Mauna Kea, some at elevations that would fall within the boundaries of the Science Reserve (see discussion in McEldowey 1982)”(1999:25). Of these however, he asserted that “to date the only positively identified human remains found in the Science Reserve are located at Site 16248 on the

summit of Pu‘u Mānaka (Fig. 1). Jerome Kilmartin, a surveyor with the United States Geological Survey, noted the presence of human remains on this prominent cinder cone in 1925”(1999:26).

McCoy differentiated stone markers, which may have commemorated visits to summit localities, from burials, which appeared to McCoy to have been associated with the top of cinder cones. Site 16195 was recorded on the eastern rim of Pu‘u Lilinoe. McCoy proposed that this burial may have been among those reported by Alexander in 1892:

The same afternoon (July 25, 1892) the surveyors occupied the summit of Lilinoe, a high rocky crater, a mile southeast of the central hills (the “summit”) and a little over 13,000 feet in elevation. Here, as at other places on the plateau, ancient graves are to be found. In olden times, it was a common practice of the natives in the surrounding region to carry up the bones of their deceased relatives to the summit plateau for burial.

Sites 21413, 21414, and 41416 consisted of single cairns, and are located on the southeastern rim of a cinder cone on the northwestern edge of the Science Reserve. These

appeared to McCoy to be similar in form and location to the burial reported at Site 16195. In his report, McCoy discusses in detail the potential for additional burials in the Science Reserve:

There is good reason to expect that more burials are to be found in the Science Reserve on the tops of cinder cones, either in cairns or in a small rockshelter or overhang. The basis for this prediction is that all of the known and suspected burial sites on the summit plateau are located on the tops of cinder cones and, more particularly, on the southern and eastern sides. No burials have been found on the sides or at the base of a cone, or on a ridgetop amongst any of the shrines. There in fact appears to be a clear separation between burial locations and shrine locations.

The apparent restriction of the higher elevation burials to the apex of cinder cones is in sharp contrast to many of the burials found at Kanakaleonui, a well-known burial center located not too far outside of the Science Reserve, just below Pu'u Makaanaka and the summit plateau, which is the lower boundary of the proposed Mauna Kea Summit Historic District. Reconnaissance of this area indicates that there are indeed a great number of structural remains at this locality. There are platforms on the top of the cone and a great number of smaller cairns at the base. On current evidence there are more burials in the general environs of Kanakaleonui than probably exist higher on the mountain, possibly on all of the summit plateau. The disproportionate number of burials in the environs of Kanakaleonui suggests that the edge of the plateau might have been a major social boundary, with the area below reserved for commoners and the plateau for persons of higher social status (chiefs and priests). If the very top of the cones were reserved for higher status individuals and the ground below for commoners, then Kanakaleonui must have both"(McCoy 1999:28).

Following this reasoning, then each of the cinder cones throughout the District could have burials not only at their summit, as earlier proposed by McCoy, but also on the lower slopes as found on Kanakaleonui, apposite McCoy's conclusion. Nonetheless, in his judgment, the only "known" burials were found at Sites 16195, 16248, 21413, 21414, and 21416 as reported in the Table 1 and Figure 2, above.

### ***Outrigger Telescopes Site***

No burials have been found or reported specifically in the area impacted by construction of WMKO, the area within which the Outrigger Telescopes will be built. The area has been graded level and a significant volume of cinders at the top of the *pu'u* was removed for the Keck Telescopes. The areas proposed for on-site construction, installation, and operation of up to six Outrigger telescopes as part of the Outrigger Telescope Project have already been severely degraded.

In reviewing the results of previous construction at the site, the SHPD has concurred with NASA's conclusion that the removal of as much as 34 feet of earth from the top of this site during the construction of Keck I effectively precludes the presence of burials. However, the nature of the leveling that went on during construction of Keck II is less clear and leaves it uncertain whether burials might still be present at moderate depths in this portion of the WMKO site. SHPD concludes that, if ground surfaces still exist that were only superficially altered, then there remains a possibility that burials might be present and that provisions for treatment of such burials should be developed (Hibbard 1999).

Based on the extensive disturbance, archaeological inventory or testing of terrain, as recommended by the Historic Preservation Plan for Mauna Kea (McEldowney 1999:9-10) would not be appropriate. However, given the possibility that human remains might be present despite the disturbance, cultural and archaeological monitoring, as recommended in the Historic Preservation Plan and the EA and MOA for the project, should be conducted, and a Burial Treatment Plan (this document) should be submitted to the Hawai'i Island Burial Council and SHPD for their review and concurrence in advance of any construction activities.

#### **IV. Recognition of Lineal and Cultural Descendants**

##### ***Documentary Research and Oral History Interviews***

The Mauna Kea Science Reserve has been the focus of several comprehensive studies of documentary and oral history investigations. Maly (1998, 1999, as well as recently updated versions of these reports 2004, in preparation) has conducted the most recent effort. He interviewed numerous individuals with long-term relationships and special knowledge of the Mauna Kea summit and native Hawaiian cultural practice. Some of this information is incorporated in the background information presented in this plan. As an outcome of his exhaustive work, Maly identified one certain burial site, as documented by W.D. Alexander (1892b). This site is the same recorded as Site 16195 by McCoy (1999).

##### ***publication of legal notices***

The following notice will be published in papers of local and statewide distribution, requesting information from any persons with knowledge about burials at the WMKO site. The proposed text of legal notice would be as follows:

#### **Public Notice**

Notice is hereby given that burial sites may be located on a Hawai'i Island land parcel, the W.M. Keck Observatory in the University of Hawai'i Astronomy Precinct, owned by the State of Hawai'i, that lie within the Mauna Kea Science Reserve on the summit of Mauna Kea. The proposed Outrigger Telescopes Project is proposed for construction at this site. The Project consists of the construction, installation, and operation of up to six 1.8 m diameter telescopes placed around the existing Keck Telescopes on the area of the cinder cone, Pu'u Hau 'Oki, that was previously disturbed for construction of the two Keck Telescopes. The project area is located in TMK: Zone 4, Sec. 4, Plat 15.

An archaeological survey has located five sites identified as Sites 50-10-15-16195, 16248, 21413, 21414, and 21416 that are thought to have been burial sites within the Mauna Kea Science Reserve on the summit of Mauna Kea. This land covers 11,288 acres leased by the University of Hawai'i from the State of Hawai'i. In addition, individuals who are known to have cultural association with the general area have been contacted directly, and these have



identified burial locales in the Mauna Kea Science Reserve Proper treatment of the burials shall occur in accordance with Chapter 6E, HRS, regarding unmarked burial sites. The property owner intends, to the extent practicable, to preserve in place, in accordance with a plan to be approved by the Hawai'i Island Burial Council, the burials present within the property. A Burial Treatment Plan is being prepared by International Archaeological Research Institute, Inc. Final decisions regarding burials shall be made by the Hawai'i Island Burial Council.

The Hawai'i Island Burial Council requests that descendants of those who may have been buried in the aforementioned property and who may have knowledge regarding these remains or others in the area to immediately contact Mary Perzinski (808) 587-0040 and/or Kana'i Kapeliela (808) 692-8037 of the State Historic Preservation Division on O'ahu within 30 days of this notice to present information regarding appropriate treatment of the human remains. Responding individuals must be able to adequately demonstrate lineal descent from the Native Hawaiian remains, or cultural descent from ancestors associated with the burials on the summit of Mauna Kea where the graves are located.

### ***Consultations***

Notification of consultations is pending publication of notice and response period.

## **V. Proposed Treatment**

### ***Preservation Plan***

In keeping with the Historic Preservation Plan prepared for the Mauna Kea Science Reserve (McEldowny 1999), each individual historic property may have significance, but also each property contributes to the Historic District as a whole. Therefore, the significance of individual properties located within the district requires evaluation and treatment "collectively and within the context of the summit's natural landscape"(1999:3). For burials, which are both historically as well as culturally significant, preservation in place is the preferred treatment.

The Historic Preservation Plan requires that inventory, testing, and mitigative treatment be conducted before any project development in the Mauna Kea Science Reserve (McEldowny 1999:7-10). In areas that are already disturbed and where the terrain is no longer intact, the Plan recommends archaeological and cultural monitoring. Procedures for monitoring and compliance with the requirements for inadvertent discovery of burials are provided in Chapter 6E-43.6 (HRS) and administrative rule 13-300-40, and also in the "Mitigation and Monitoring Measures for the Outrigger Telescopes Project (Appendix G, Environmental Assessment for the Outrigger Telescopes Project, Mauna Kea Science Reserve, Island of Hawai'i).

In-place preservation would be the preferred treatment, where practicable, and this would be achieved through the establishment of defined preservation buffers. (described below).

### ***Preservation site buffers***

A buffer zone of 6.1 m (20 ft) will be established around the perimeters of burial sites except where this is incompatible with the Outrigger Telescopes Project design. Where a 6.1-m buffer zone would be incompatible with the Project design, either a smaller buffer zone will be established or the burial will be relocated. No land disturbing activity will occur within the buffer zones.

### ***inadvertent burial discoveries***

This section of the Burial Treatment Plan provides guidelines and procedures for dealing with the inadvertent discovery of human remains during any activity at the Mauna Kea Science Reserve. The guidelines and procedures follow HRS 6E-43.6 (entitled “Inadvertent Discovery of Burial Sites”) and the DLNR Administrative Rules Section 13-300-40.

## **Construction Monitoring**

In order to insure recognition and proper treatment of any burial remains that may be inadvertently discovered during construction, construction activities will be monitored by an archaeologist and a cultural monitor, in accordance with the stipulations of the Memorandum of Agreement (MOA) prepared in connection with the Environmental Assessment for the Outrigger Telescopes project. NASA will be responsible for insuring that monitoring is undertaken as stipulated in the MOA.

## **During Construction**

The following actions will be taken during all ground alteration activities.

1. An archaeological monitor will be present during all ground alteration activities, such as grading, grubbing, and excavation during any construction activities in the project area.

## **Following Construction**

Following ground alteration activities, the professional archaeologist will prepare a report that meets all requirements of SHPD Administrative Rules 13-279-7, as well as documents (1) the measures taken to implement short-term preservation measures for burials and (2) any new burials that may have been uncovered. This report will be submitted to the SHPD.

## **Procedure for Inadvertent Burial Discoveries**

SHPD Administrative Rules 13-300-40 lay out the procedure for inadvertent discoveries of human remains. In the event that previously unknown human remains are exposed during any action related to the development of the Mauna Kea Science Reserve, all

work in the vicinity of the burial site shall cease (although work may continue in other areas of the development) and the remains shall be left in place and protected from further damage. Human remains may also be inadvertently exposed by natural events, such as storm erosion.

The SHPD Hawai‘i Island archaeologist, the Hawai‘i County Police Department, and the Hawai‘i County medical examiner coroner shall be notified. The SHPD will inform the representative of the Hawai‘i Island Burial Council of the discovery and the time that a site visit will be made. The Police Department has jurisdiction if the remains appear to be less than 50 years old; the SHPD has jurisdiction if they appear to be more than 50 years old.

If the remains are more than 50 years old, SHPD has three days to determine if they should be preserved in place or relocated. Remains shall be relocated if preservation in place is incompatible with the Project design. The SHPD determination will be made in consultation with landowners, any known lineal or cultural descendants, and appropriate ethnic organizations. When practicable, remains shall be preserved in place. If relocation is required, then provisions of this Burial Treatment Plan will be followed.

Once appropriate measures have been taken for protection or removal of the remains, development work in the area can resume.

## **Long-Term Preservation Treatment**

Long-term preservation requirements address potential impacts from on-going use and occupation of the Mauna Kea Science Reserve.

1. All inadvertently discovered burial sites, whether in place or removed, will be set aside as preserves and will include a buffer zone that recognizes the surrounding landscape context of the site, although it will be a minimum of 6.1 m (20 ft) unless a buffer zone of such size is incompatible with the Project design. The site boundaries will be defined by an in-field evaluation of the relationship among described features and any surrounding undocumented features. Terrain features such as steep slopes that could act as a natural buffer will be considered in the final definition of buffer widths.

2. The burial site will be defined by berms, walls, or a combination of these elements, so long as there is no adverse effect on the historic property and historic district. The purpose of this physical delineation is to clearly define the site and buffer boundaries and to protect the site from potential harm from unauthorized access. The physical barriers will be of such design that blends with the surrounding area.

3. Perpetual access to burial sites shall be granted to known lineal or cultural descendants.

## ***maintenance and security***

Responsibility for maintenance and security of the burial site would lie with the University of Hawai‘i. Actual implementation could be placed in the hands of the Office of Mauna Kea Management or a successor organization, if any, that assumes its responsibilities.

Long-term/permanent in-place preservation would be achieved by a means of a Memorandum of Agreement between the Hawai'i Burial Council and the California Association for Research in Astronomy, project manager, which would include the appropriate requirements and restrictions relating to physical improvements, maintenance, security, and access by recognized lineal and/or cultural descendants.

### ***Access for Lineal and/or Cultural Descendants***

Access to the burial site for appropriate cultural activities would be permitted to any lineal and/or cultural descendant formally recognized by the HIBC or DNLR-SHPD in accordance with the administration procedures contained within Section 13-300-35: "Recognition of lineal and cultural descendants (DLNR 1006). Specific arrangements for access would be made by direct, mutual agreement between the University of Hawai'i and recognized lineal and/or cultural descendants.

## **VI. Implementation of the Burial Treatment Plan**

Preservation measures contained in the Burial Treatment Plan would be implemented by the California Association for Research in Astronomy, project manager, following receipt by the applicant of DLNR written confirmation of mutual agreement to these measures.

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